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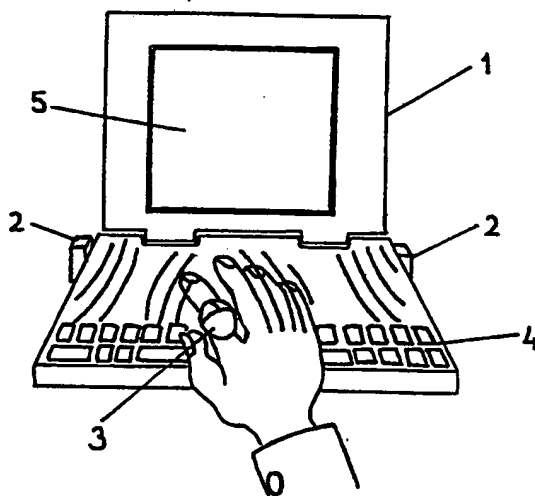
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(54) Title: REMOTE SENSING COMPUTER POINTER



(57) Abstract

Disclosed is a cursor control device or pointer for a computer including means to detect the movement of a user's hand in space and translation means to translate the detected movement into signals to control the movement of a cursor on a visual display unit of the computer. In a preferred form, two ultrasonic receivers and an infrared transmitter are mounted spaced apart at one end of the keyboard of a computer. Power is supplied and signals communicated to and from the receivers and transmitter through the communications port of the computer. The infrared transmitter is used to transmit a synchronisation signal to an infrared receiver in a pointer means adapted to be worn on a finger. The signal received by the infrared receiver is retransmitted as an ultrasonic signal by an ultrasonic transmitter also mounted in the pointer means. Power for the electronics of the pointer means can be supplied by a small battery. The transmitted ultrasonic signal is received by the ultrasonic receivers and by comparing the phase relationship of each received signal and the synchronisation signal it is possible to establish the distance from each ultrasonic receiver to the pointer means. The pointer means preferably is attachable to a user's hand and is of a size and attachment that the pointer means does not hinder normal typing. In a further preferred form the pointer means includes a switch or button which can be used to signal the computer as is well known with conventional computer mice.

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REMOTE SENSING COMPUTER POINTER**BACKGROUND OF THE INVENTION**

This invention relates to a cursor control device for computers. It will be appreciated that the invention can be used with many computerised devices
5 such as personal computers, main frame computers and televisions where it is desired to control a cursor appearing on a display screen.

In recent years graphic user environments for computers have become very popular. These include not only the conventional CAD/CAM applications that have been in use for a number of years but also icon based operating
10 environments. A side effect of this popularity has been the sale of large numbers of cursor control devices on which these environments rely.

Currently there are three main types of cursor control devices for personal computers.

The Mouse is by far the most popular cursor control device for computers.
15 This is supplied as a standard device on many personal computers and is a very common accessory on many others. It operates by converting a signal derived from the movement of the mouse over a surface to a signal which controls the position of a cursor on a visual display unit of the computer.

The Trackball is an alternative to the mouse when desk space is limited. It is
20 operated by rotating a ball in a socket, the relative movement of the ball being converted to movement of the cursor on the VDU. It is essentially an inversion of the mouse principle.

The third device is the Touch Pad. This device relies on a finger or stylus being moved across a position sensitive pad. It is mostly commonly used for
25 CAD/CAM applications.

Other cursor control devices are known. The problem with existing devices is that they require the hand to be moved from the keyboard in order to operate the device. These devices are ideal for applications with very little or no keyboard usage such as CAD/CAM, drawings, games, etc. They are not so
30 good for business applications such as accounting, word-processing and

spread-sheets where the bulk of the input is through the keyboard. With these, the need to lift the hand from the keyboard, find the mouse, move it, click a button and return the hand to the keyboard is a slow and unnatural process. As a result, keys are often used in preference to the mouse, despite
5 requiring a lot of key pressing and often the use of both hands to operate the "control" or "alt" keys.

A mouse, a touch pad and to a lesser extent track balls, also require desk space which is often in short supply, particularly in aircraft, airport lounges, etc. With the increasing popularity of lap-top computers this has become a
10 major problem. To date, no suitable solution to the operation of a cursor control device in the absence of desk top has been found.

It is an intended object of this invention to alleviate one or more of the above-mentioned problems or at least provide the public with a useful alternative.

SUMMARY OF THE INVENTION

15 Therefore, according to one form the invention, resides in a cursor control device for a computer with a visual display means comprising :
pointer means attachable to a user's hand;
position sensing means adapted to detect a position of the pointer means relative to the position sensing means;
20 translator means adapted to translate pointer position information generated by the position sensing means into a computer intelligible form such that a cursor on the visual display means is moved in accordance with movement of the pointer means.

It will be appreciated that use of a pointer means attached to a user's hand
25 dispenses with the necessity of moving the hand from the keyboard to operate a mouse. As a result keyboard operations are sped up. This can lead to an increased efficiency in data entry.

In preference the cursor control device is further characterised by the position
30 sensing means including at least one transmitter and at least one receiver, the transmitter or transmitters being adapted to transmit a signal which is receivable by the receivers and wherein the position of the pointer means is determined by calculating the phase difference between the transmitted signal or signals and the signal received by the receiver or receivers.

5 In a preferred form, the transmitter or transmitters are adapted to transmit into the vicinity of the pointer means above the keyboard, the receiver or receivers are releasably attached to, fixed to or incorporated within a computer in a spaced apart relationship, and the pointer means includes reflective means adapted to reflect transmitted signals to the receivers.

10 In this form the pointer means need not have an electrical power source. As a result the size and weight of the pointer means can be reduced and also the complexity of the pointer means simplified. Further, the reflective means can be switchable from a reflecting state to a non-reflecting state with respect to transmitted signals. This can be achieved by the reflective means being hidden from the transmitted signals until the pointer means is desired to be used to control the position of a cursor on a computer display unit.

15 Alternatively, when a user desires to use the pointer means a predetermined key sequence may be typed and then the pointer means moved to control the cursor.

The transmitters may be ultrasonic devices in which case the reflective means is a metal-coated plastic device or may be optical devices in which case the reflective means is a retroreflecting prism.

20 In preference a transmitter and a receiver are integrally formed into a transducer and there are at least two transducers releasably attached to, fixed to, or incorporated with a computer in spaced apart relationship.

25 It is convenient and functionally suitable to position the transducers at one or both sides of a computer keyboard or visual display unit. Two spaced apart transducers are sufficient to provide the appropriate precision in the determination of the position of the pointer means to result in the required cursor control accuracy on the VDU. If a greater degree of accuracy is required further transducers can be employed.

30 Power and signals for the transducers may conveniently be drawn from an output port of the computer. The output port may be the mouse port or a serial port supplied as standard on most computers.

In another preferred form there is proposed a cursor control device for a computer with a visual display means comprising :

- a pointer means incorporating an electromagnetic receiver and an ultrasonic transmitter;
- two ultrasonic receivers mounted in spaced apart relation on the computer;
- an electromagnetic transmitter mounted in the vicinity of the ultrasonic
- 5 receivers said electromagnetic transmitter being adapted to transmit a synchronisation signal to the electromagnetic receiver;
- buffering means incorporated in the pointer means adapted to buffer said synchronisation signal to said ultrasonic transmitter for retransmission as an ultrasonic signal receivable by said ultrasonic receivers as a received
- 10 ultrasonic signal; and
- translator means adapted to compare the phase relationship between the synchronisation signal and the received ultrasonic signal to determine the position of the pointer means and translate said position of the pointer means into computer intelligible form such that a cursor on the visual display means
- 15 is moved in accordance with movement of the pointer means.

In preference power and signals are supplied to and from the ultrasonic receivers and electromagnetic transmitter by supply means communicating with an output port of the computer. Power for the pointer means is preferably supplied by a battery although further supply means could be provided.

- 20 Whilst the active pointer means disclosed herein incorporates a battery as the preferred power source, it will be appreciated that power can be supplied to the pointer means by use of wires. Further, it will be appreciated that the power can be supplied to the pointer means by use of transponder techniques where a signal is received and energy therein is used to power a subsequent
- 25 transmission.

In preference the electromagnetic transmitter is an infrared transmitter and the electromagnetic receivers are infrared receivers.

- It will be appreciated that the locations of the ultrasonic transmitters and receivers and the electromagnetic transmitter and receiver may be reversed,
- 30 that is the transmitter on the pointer means becomes a receiver, the receivers attached to the key board become the transmitters and the infra red receiver and transmitter are swapped. In this form, each ultrasonic transmitter transmits alternatively and the electromagnetic link is used to transmit the received signal at the pointer for comparison with the transmitted ultrasonic
- 35 signal.

Whilst the separation between the ultrasonic receivers can be minimal, it has been found that a significant spacing assists in determining the position of the pointer means. The ultrasonic receivers may be positioned at either side of a keyboard of the computer for maximum separation however it has been found
5 sufficient to space the ultrasonic receivers apart on one side of a keyboard of the computer. In this case the electromagnetic transmitter may be conveniently located between the ultrasonic receivers.

It has been found that a pointer means can be constructed of appropriate material and of a suitable to size and shape to minimise hindrance to normal
10 typing. In preference the pointer means includes a band adapted to attach the pointer means to the wrist or fingers of the user's hand.

Preferably, the pointer means is attached to the user's hands by a flexible band, the band may surround the wrist or be adapted to go about the fingers below the first and above the second knuckles, or be adapted to pass about a
15 finger. By such means the pointer means is held to a user's hand and need not hinder the user during typing.

Preferably, the pointer means is characterised by at least one button being incorporated into the band from which means the user can transmit a message to the computer. With the pointer means attached to the first finger, a
20 button or buttons may be positioned to be operable by a user's thumb. However, it will be appreciated that the pointer means can be placed upon other fingers and if desired a button can be pressed by the closing of fingers. Further, if the pointer means is attached to the hand by a band going around the fingers between the first and second knuckle then a button or buttons may
25 be positioned also to be operable by the users thumb.

In a still further form the invention resides in a method of controlling the position of a cursor on a visual display unit of a computer, including the steps of :
communicating a first signal or signals from a first transmitting means attached
30 to the computer to first receiving means incorporated in the pointer means;
further communicating a second signal or signals from the pointer means by second transmitting means to second receiving means attached to the computer;
determining a position of the pointer means relative to the second receiving
35 means by calculating the phase differences between the first and second

signal or signals;

translating said position of the pointer means into computer intelligible form such that a cursor on the computer display means is moved in accordance with movement of the pointer means.

- 5 In preference the first transmitting means transmits electromagnetic signals and the second transmitting means transmits ultrasonic signals.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of this invention preferred embodiments will now be described with reference to the attached drawings in which:

- 10 FIG. 1 is a schematic diagram of a computer employing the invention,
FIG. 2 is schematic of the principle of determining the position of the pointer means,
FIG. 3 is a block diagram of the major components of the cursor controlling device,
- 15 FIGS. 4a and 4b are schematic diagrams of the interface electronics according to one preferred embodiment,
FIG. 5 is a drawing of a first preferred embodiment of the pointer means,
FIG. 6 is a drawing of a second preferred embodiment of the pointer means,
- 20 FIG. 7 is a drawing of a third preferred embodiment of the pointer means,
FIG. 8 is a drawing of a fourth preferred embodiment of the pointer means, and
FIG. 9 is a drawing of a laptop computer illustrating transmitter configuration according to one preferred embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In a first embodiment the pointer means is passive and incorporates a reflector. In a subsequent and most preferred embodiment the pointer means is an active unit and incorporate a transmitter.

- 5 Referring now in detail to the drawings, a computer 1 is fitted with a pair of transducers 2. Transducers being useful as transmitters and also as receivers. In this embodiment the transducers are ultra-sonic transducers with an operating frequency exceeding 40KHz. Such transducers can be purchased as off the shelf components.
- 10 The transducers emit an ultrasonic signal which is retro-reflected by a reflector 3. The phase relation between the reflected and transmitted beams determines the distance from the transducer 2 to the reflector 3. Thus, the position of the reflector is uniquely defined by the distances 6 and 7 from the respective transducers 2.
- 15 The distance 6 and 7 are translatable to a position on the visual display unit 5. The translation means 9 converts the signals derived from the transducers into positional co-ordinate which are translated to signals which are input to the mouse port 10 of a computer 11. Software on the computer translates the receive signals to cursor positions on the visual display unit 5. The software is
- 20 analogous to the software used to drive current technology devices such as a mouse.

- The transducers 2 can conveniently be powered from the serial port 8 of the computer 11. Alternatively, power can be derived from signals passed to the computer via the same port. This can be either the serial port 8 or the mouse
- 25 port 10.

- In another preferred embodiment the position sensing means includes an infrared signal transmitter 12 and two ultrasonic receivers 13 and 14. Referring to Figure 4, a transmit signal is generated from oscillator 15 by dividing the output of oscillator 15 with divider 16 to a 40KHz signal and
- 30 applying this through buffer 17 to infrared transmitter 12.

The received signals of each receiver 13 and 14 are amplified by amplifiers 18 and 19 respectively. The received signals are compared with the transmit signals and the phase difference is calculated. The determined phase difference is calculated by processor 20 which communicates via an RS232 link to the computer.

In a this embodiment the pointer means includes an infrared receiver and an ultrasonic transmitter. The infrared signal transmitter 12 and two ultrasonic receivers 13 and 14 are affixed to the computer at one side of the keyboard, as shown in FIG 9. In this embodiment the pointer means is an active device and is powered by a battery.

The pointer means can take a number of forms, some of which are illustrated in the accompanying diagrams. The first form is illustrated in Figure 5 where it can be seen that the pointer means 21 is shaped and sized to include a band so as to fit over a finger 22 of a user's hand 23. The size and weight of the pointer means 21 is such that a user can type without hindrance from the pointer means 21. The pointer means includes an ultrasonic transmitter 24 and an infrared photo-transistor 25. The photo-transistor 25 is used to receive the 40KHz pulse train transmitted by the infrared transmitter 12. As a result the ultrasonic pulse train transmitted by ultrasonic transmitter 24 of the pointer means is synchronised to the transmit signal applied to transmitter 12. This is necessary so as to ensure that the phase difference detected will be attributable to distances 6 and 7.

The pointer means also incorporates a button 26. Button 26 is used to switch the pointer means 21 into an active mode and also to act as a select button in a similar means as is well known in computer mouse systems. It will be appreciated that there can be a number of buttons although one is preferred due to size limitations. It will be apparent that the button 26 can be activated by the user's thumb 27.

It will be appreciated that button 26 can be omitted and key strokes used in place of the button 26. In this form the pointer means is only being used to indicate the desired movement of the cursor.

The form of the pointer means shown in Figure 6 is similar to that of Figure 5 except the band is adapted to slide over the fingers and rest between the first

and second knuckles 28 and 29. In this case key strokes can be used instead of the button 26.

5 The form of the pointer means shown in Figure 7 is similar to that in Figure 6 except that button 30 is included. Operation of the button 30 is by the user's thumb and its uses are the same as that for button 26.

A further form of the pointer means is disclosed in Figure 8 where it can be seen that the band of the pointer means 31 is adapted to hold the pointer means 31 to the wrist of a user. This form is similar to that disclosed in Figure 7.

10 In Figure 9 a laptop computer is illustrated which includes a keyboard 33 and a display 34. The receivers 35 and 36 are spaced apart at a side of the keyboard 33. This form is useable with the pointer means of Figures 5 to 8 inclusive.

15 The major advantages offered by the cursor control device over existing devices are :

1. It requires no desk space or other horizontal surface on which to operate. It is therefore particularly suitable for use with laptop computers;
2. The device may be permanently fitted to a laptop computer, giving the user quicker and easier portability; and
- 20 3. It is quicker and more convenient to use than existing devices because the user does not have to move a hand far away from the normal data entry position on the keyboard.

Throughout the specification the purpose has been to illustrate the invention and not to limit the invention to any specific detail of any specific embodiment.

CLAIMS:

1. A cursor control device for a computer with a visual display means comprising :
pointer means attachable to a user's hand;
position sensing means adapted to detect a position of the pointer means
5 relative to the position sensing means;
translator means adapted to translate pointer position information generated
by the position sensing means into a computer intelligible form such that a
cursor on the visual display means is moved in accordance with movement of
the pointer means.
- 10 2. A cursor control device as in claim 1 further characterised by the
position sensing means including at least one transmitter and at least one
receiver, the transmitter or transmitters being adapted to transmit a signal
which is receivable by the receivers and wherein the position of the pointer
15 means is determined by calculating the phase difference between the
transmitted signal or signals and the signal received by the receiver or
receivers.
- 20 3. A cursor control device as in claim 2 in which the transmitter or
transmitters are adapted to transmit into the vicinity of the pointer means
above the keyboard, the receiver or receivers are releasably attached to, fixed
to or incorporated within a computer in a spaced apart relationship, and the
pointer means includes reflective means adapted to reflect transmitted signals
to the receivers.
- 25 4. A cursor control device as in claim 3 in which the reflective means can
be switched from a reflective state to a non-reflective state with respect to a
transmitted signal.
5. A cursor control device as in claim 3 in which the transmitter or
transmitters operate at ultrasonic frequencies and the reflective means is a
metal-coated plastic device.
- 30 6. A cursor control device as in claim 3 in which the transmitter or
transmitters operate at infrared frequencies and the reflective means is a
retroreflecting prism.

7. A cursor control device as in claim 3 in which a transmitter and a receiver are integrally formed in a into a transducer and there are at least two transducers releasably attached to, fixed to, or incorporated with a computer in spaced apart relationship.
- 5 8. A cursor control device as in claim 7 wherein power and signals for the transducers are drawn from an output port of the computer.
9. A cursor control device for a computer with a visual display means comprising :
- 10 a pointer means incorporating an electromagnetic receiver and an ultrasonic transmitter;
- two ultrasonic receivers mounted in spaced apart relation on the computer;
- an electromagnetic transmitter mounted in the vicinity of the ultrasonic receivers said electromagnetic transmitter being adapted to transmit a synchronisation signal to the electromagnetic receiver;
- 15 buffering means incorporated in the pointer means adapted to buffer said synchronisation signal to said ultrasonic transmitter for retransmission as an ultrasonic signal receivable by said ultrasonic receivers as a received ultrasonic signal; and
- 20 translator means adapted to compare the phase relationship between the synchronisation signal and the received ultrasonic signal to determine the position of the pointer means and translate said position of the pointer means into computer intelligible form such that a cursor on the visual display means is moved in accordance with movement of the pointer means.
10. A cursor control device as in claim 9 in which power and signals are
- 25 supplied to and from the ultrasonic receivers and electromagnetic transmitter by supply means communicating with an output port of the computer.
11. A cursor control device as in claim 9 in which the electromagnetic transmitter is an infrared transmitter and the electromagnetic receivers are infrared receivers.
- 30 12. A cursor control device for a computer with a visual display means comprising :
- a pointer means incorporating an electromagnetic transmitter and an ultrasonic receiver;
- two ultrasonic transmitters mounted in spaced apart relation on the computer

and wherein each ultrasonic transmitter transmits alternatively;
an electromagnetic receiver mounted in the vicinity of the ultrasonic
transmitters said electromagnetic receiver being adapted to receive a
synchronisation signal from the electromagnetic transmitter, said
5 synchronisation signal being a buffered, retransmitted signal derived from the
signal transmitted by the ultrasonic transmitters; and
translator means adapted to compare the phase relationship between the
synchronisation signal and the transmitted ultrasonic signal to determine the
position of the pointer means and translate said position of the pointer means
10 into computer intelligible form such that a cursor on the visual display means
is moved in accordance with movement of the pointer means.

13. A cursor control device as in any preceding claim in which the pointer
means is attached to the user's hand by a flexible band.

14. A cursor control device as in claim 13 characterised by the pointer
15 means being attachable to the user's hand at the wrist.

15. A cursor control device as in claim 13 characterised by the pointer
means being attachable to the user's hand by the band wrapping about the
fingers below the first and above the second knuckle.

16. A cursor control device as in claim 13 characterised by the pointer
20 means being attachable to the user's hand by the band wrapping about a
finger.

17. A cursor control device as in claim 13 further characterised by there
being at least one button incorporated into said band by which the user can
transmit a signal to the computer.

25 18. A cursor control device as in any preceding claim in which the pointer
means is of a size and shape adapted to minimise hindrance to normal typing.

19. A method of controlling the position of a cursor on a visual display unit
of a computer, including the steps of :
communicating a first signal or signals from a first transmitting means attached
30 to the computer to first receiving means incorporated in the pointer means;
further communicating a second signal or signals from the pointer means by
second transmitting means to second receiving means attached to the

computer;

determining a position of the pointer means relative to the second receiving means by calculating the phase differences between the first and second signal or signals;

- 5 translating said position of the pointer means into computer intelligible form such that a cursor on the computer display means is moved in accordance with movement of the pointer means.

20. The method of claim 19 wherein the first transmitting means transmits electromagnetic signals and the second transmitting means transmits
10 ultrasonic signals.

21. The method of claim 19 further including the step of activating the cursor control device by pushing of a button incorporated with the pointer means.

22. A cursor control device as herein described with reference to the
15 attached drawings.

23. A method of controlling the position of a cursor on a visual display unit of a computer as herein described.

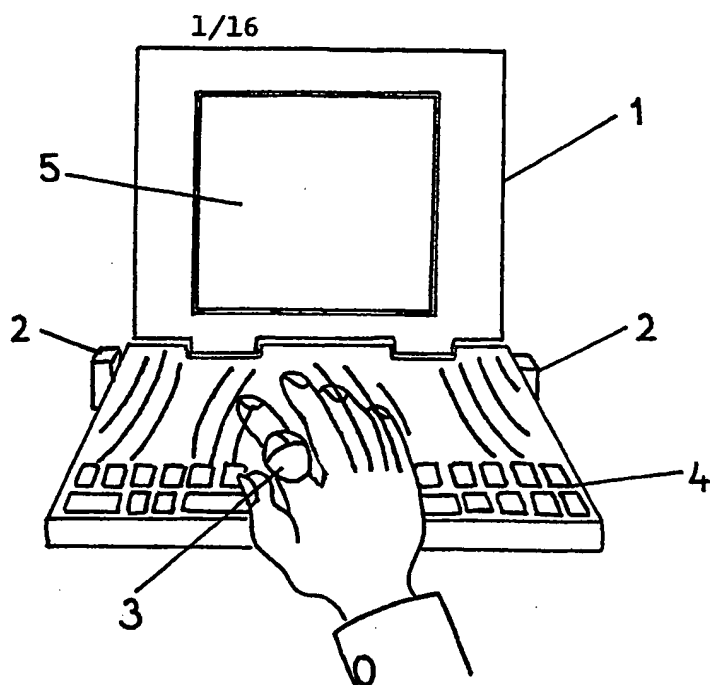


FIG 1

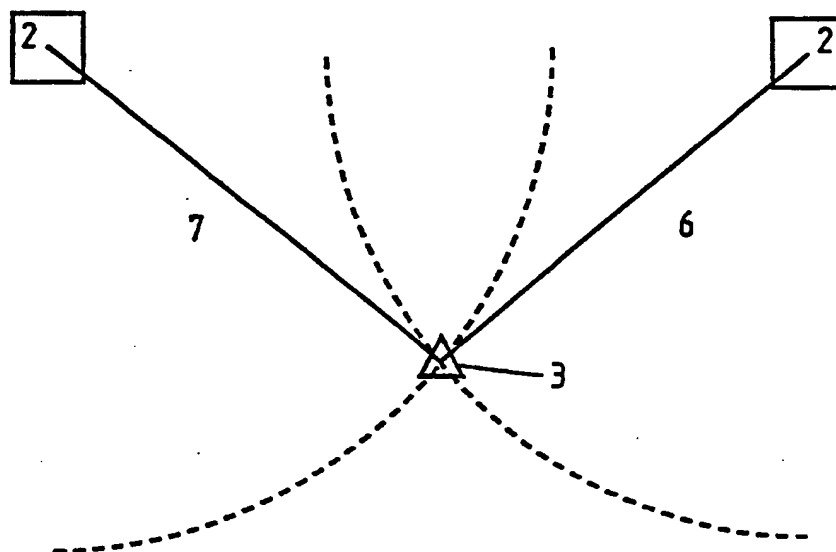
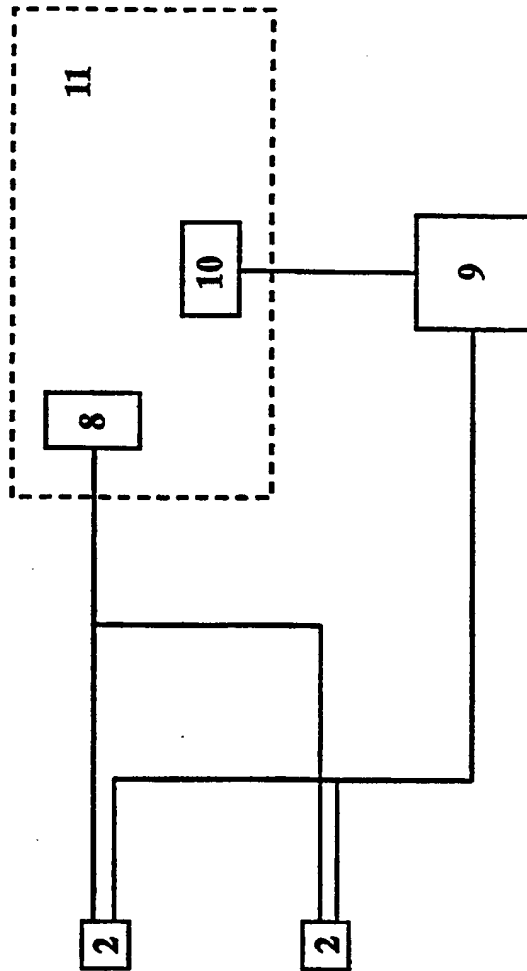


FIG 2

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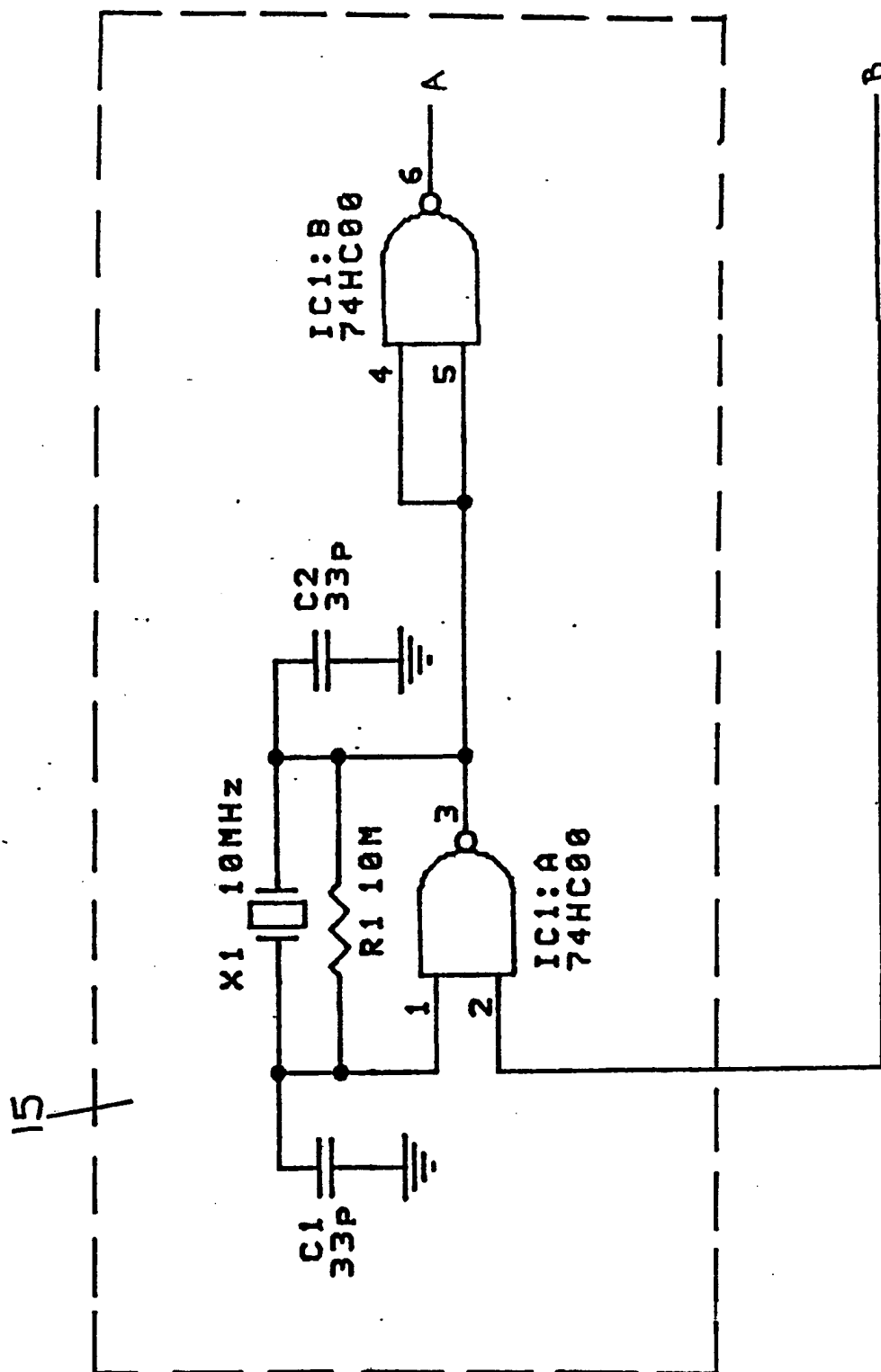


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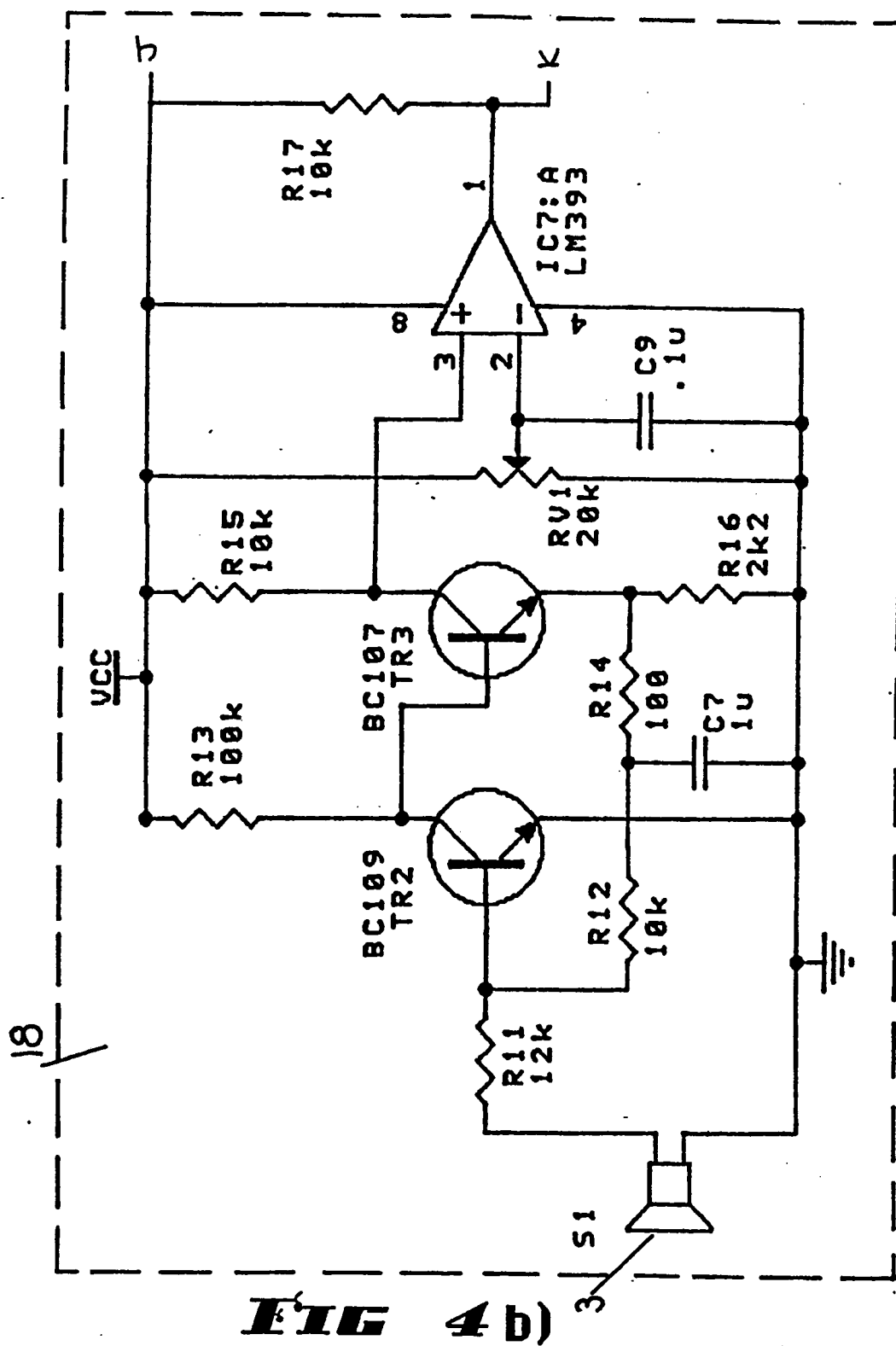
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**FIG 4 a)**

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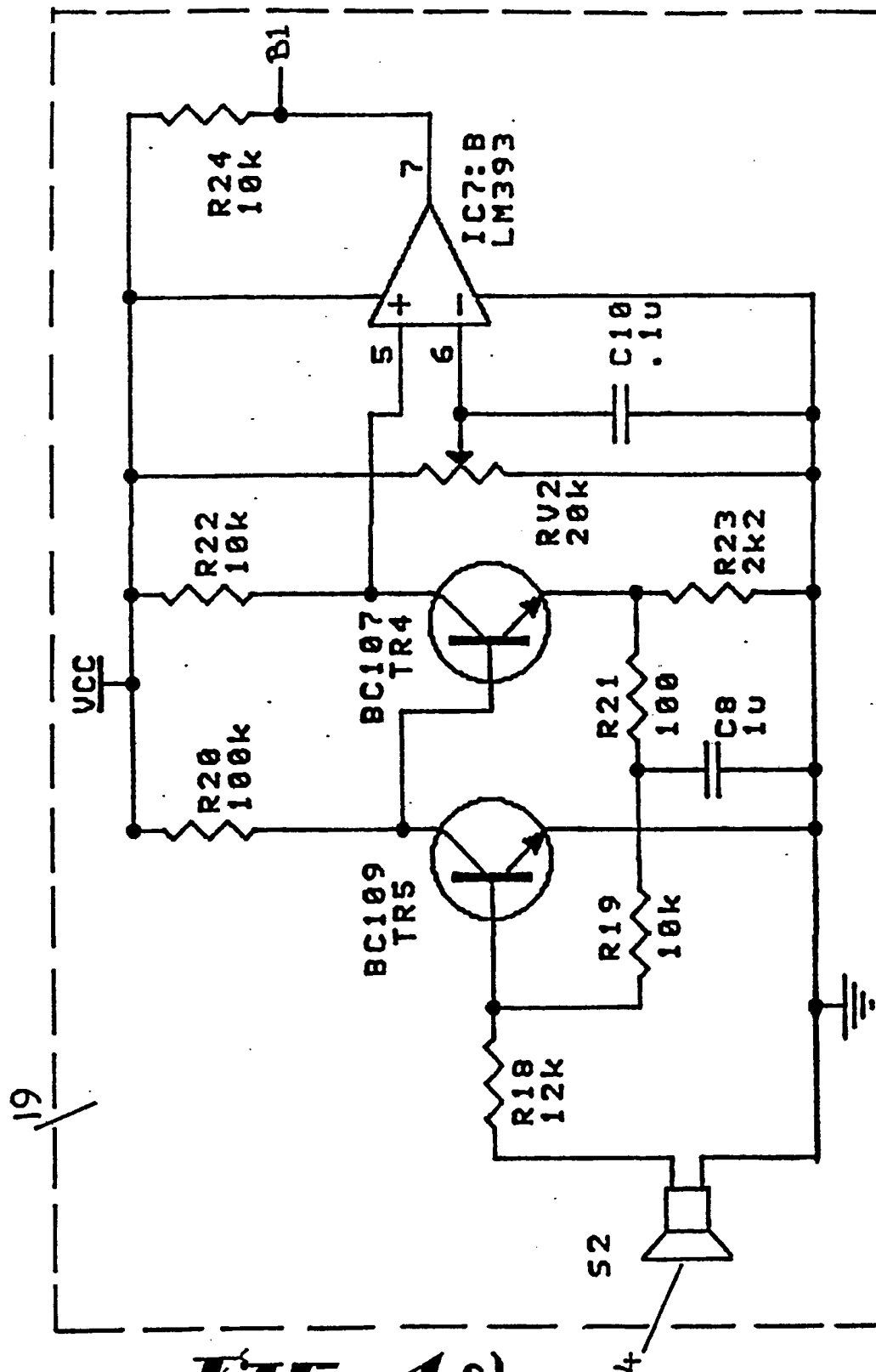


FIG 4 c)

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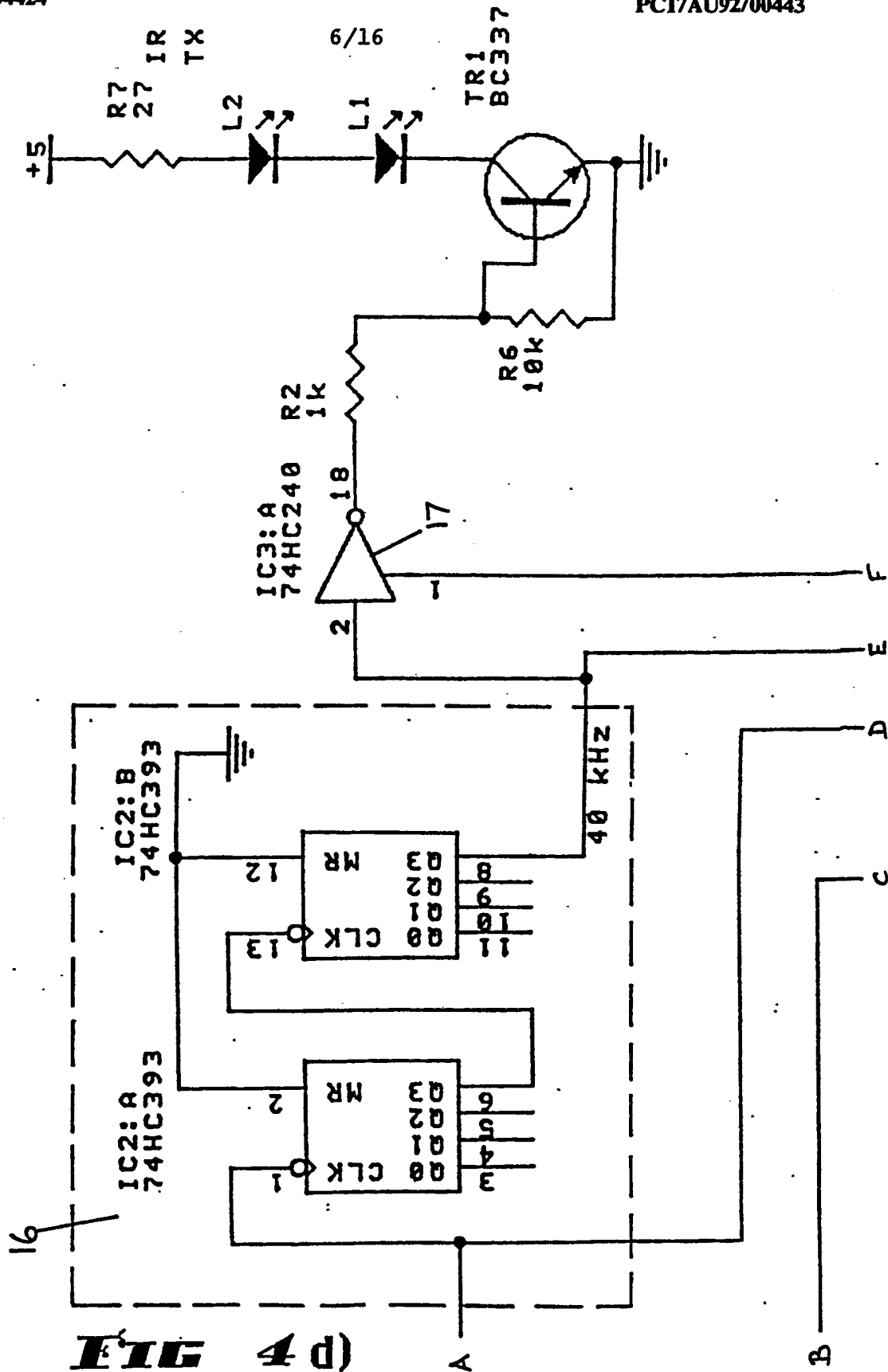


FIG 4 d)

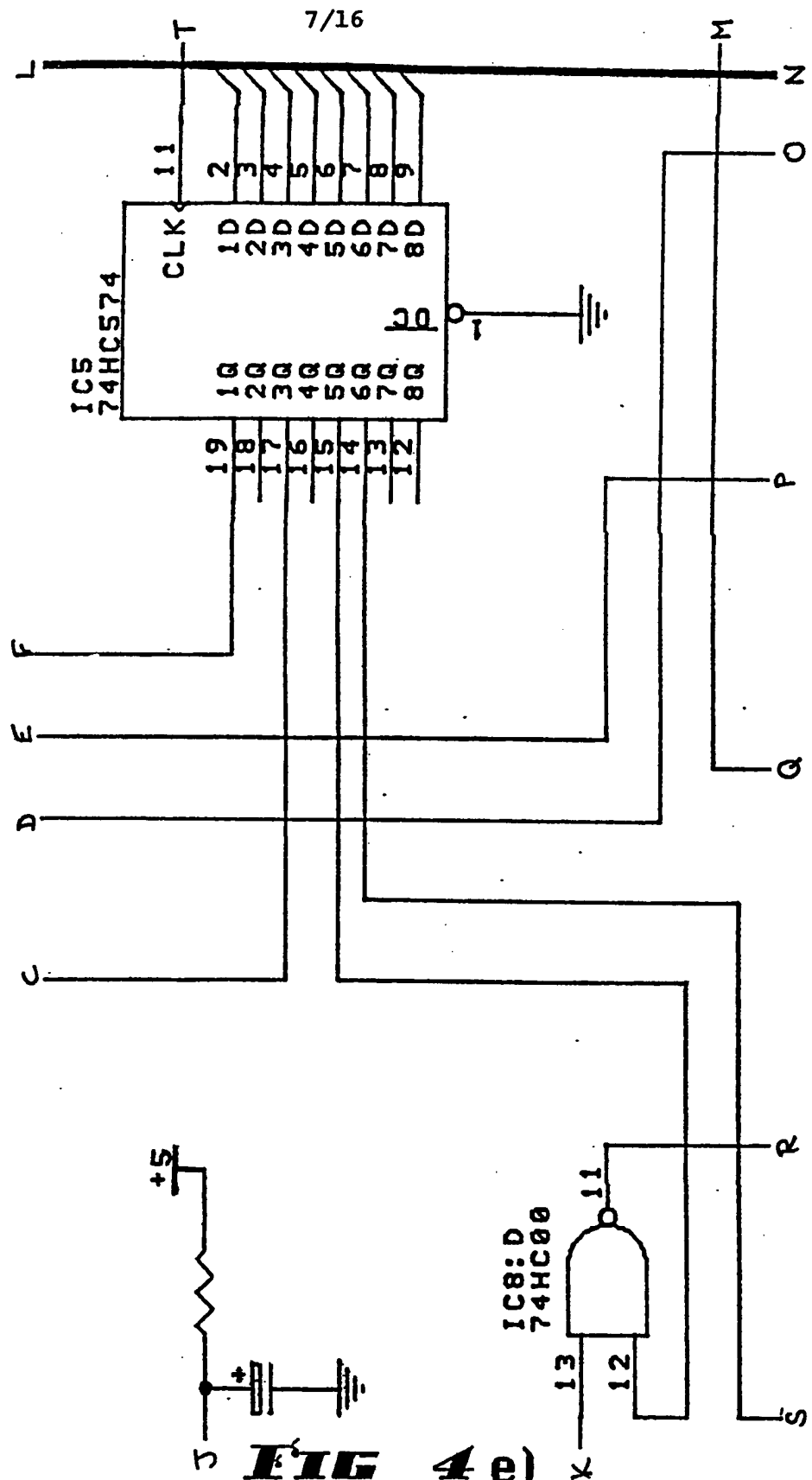


FIG 4 e)

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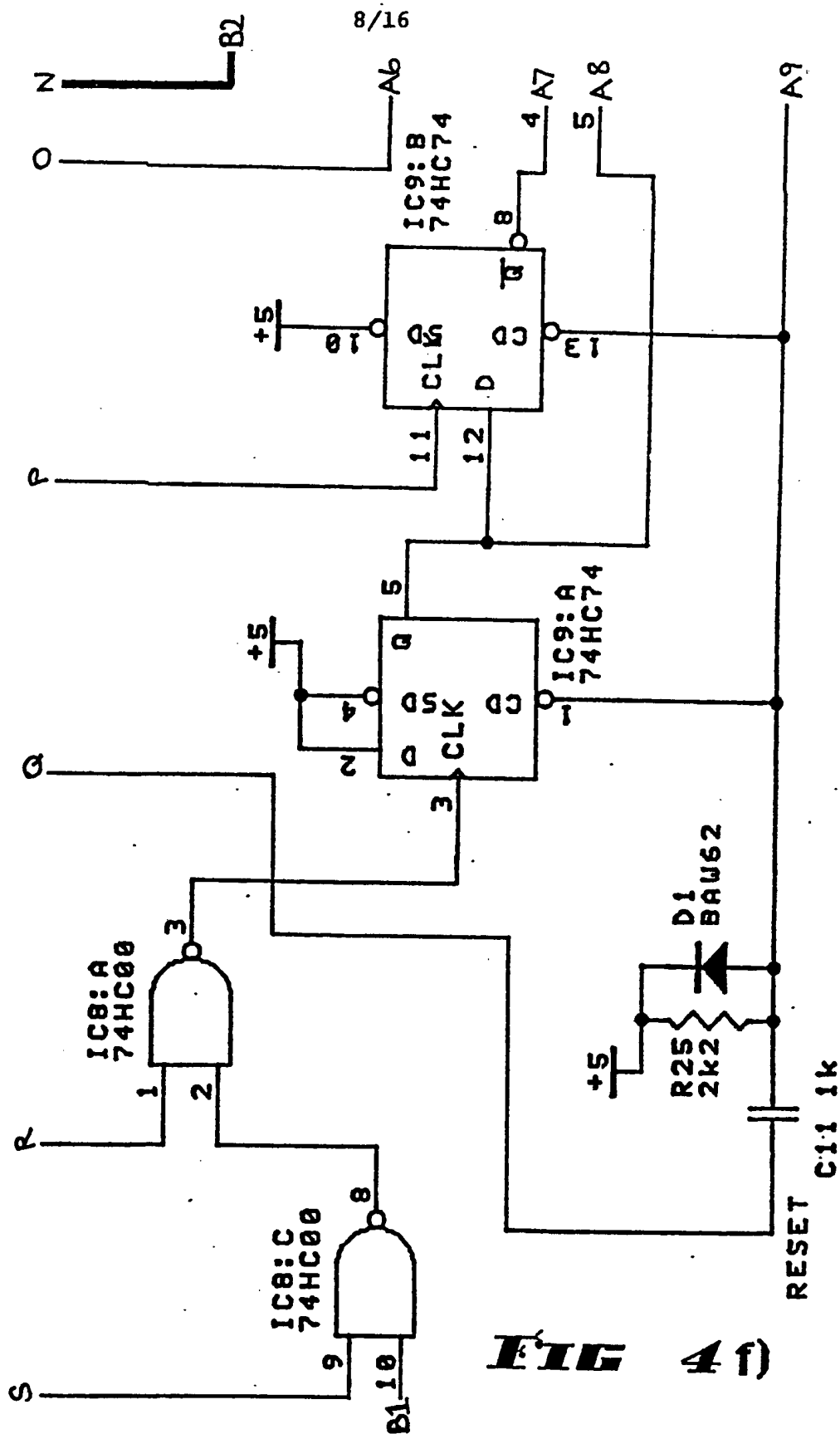


FIG 4f)

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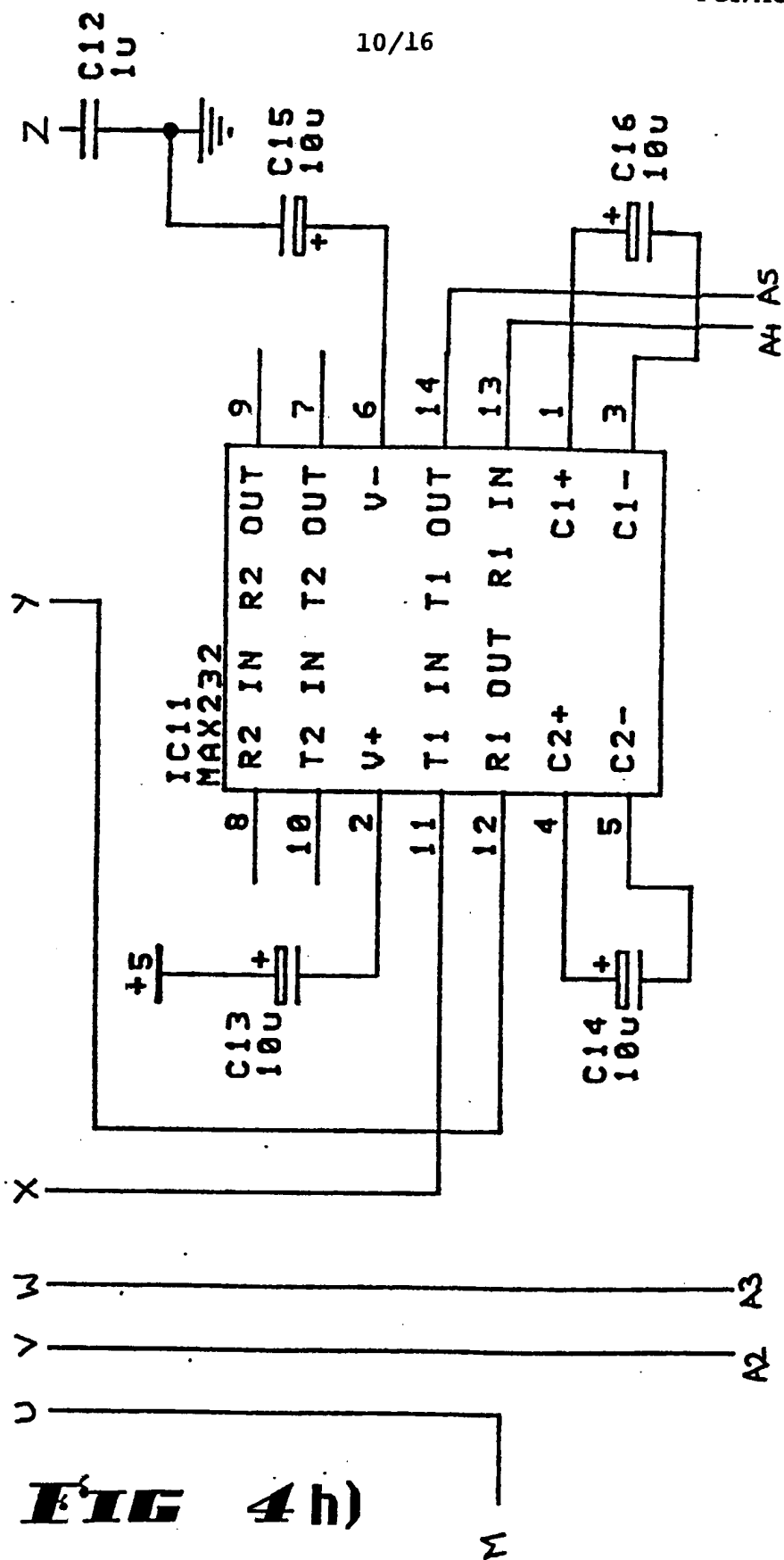


FIG 4h)

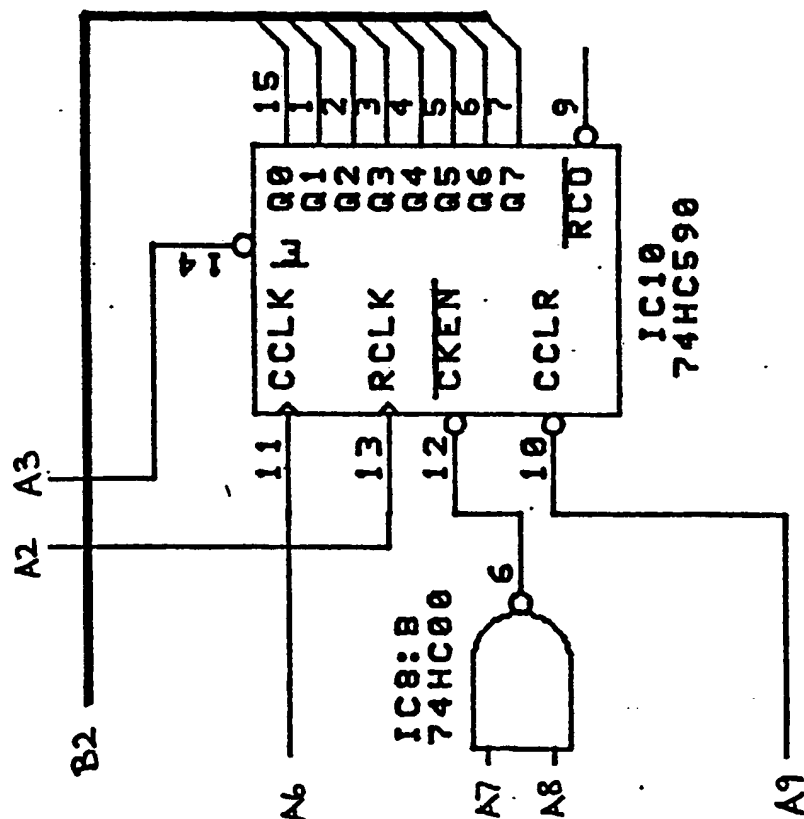
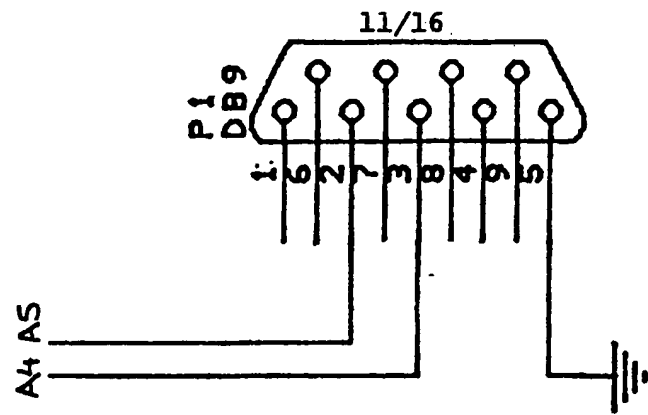


FIG 4i)

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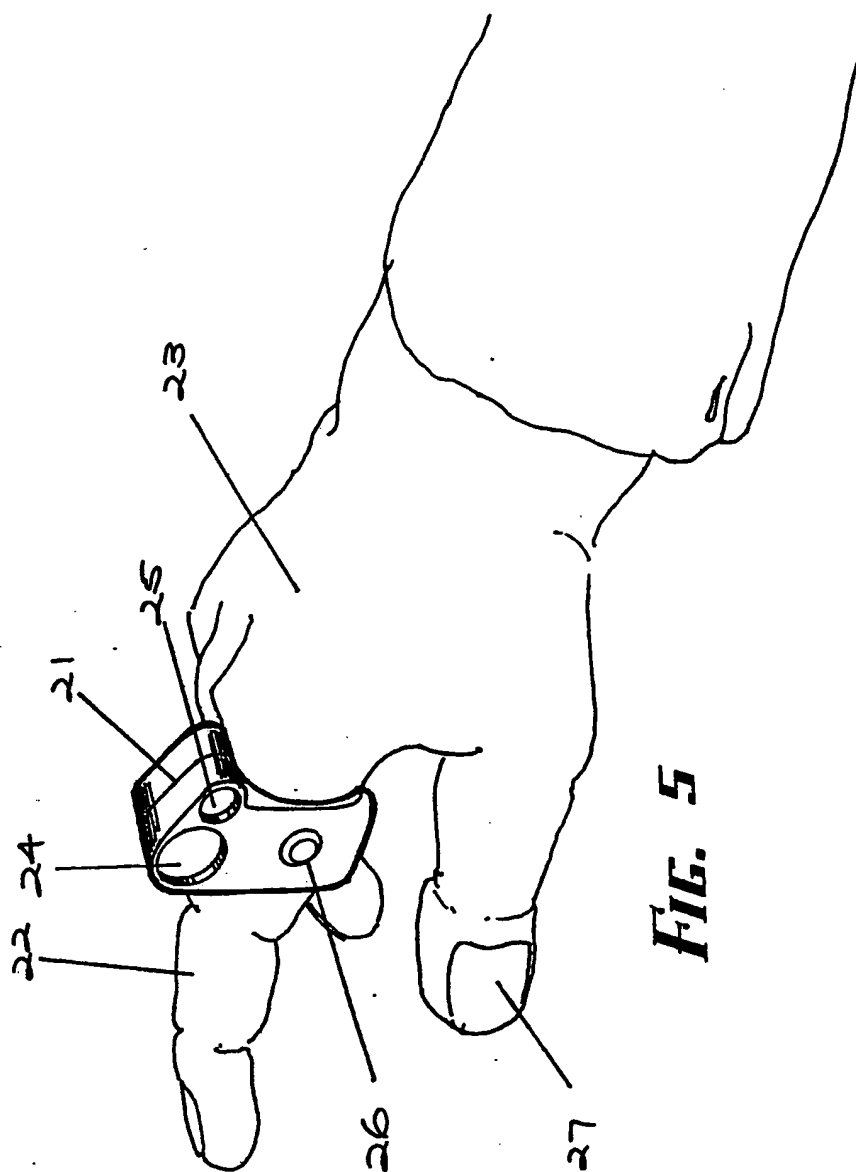


FIG. 5

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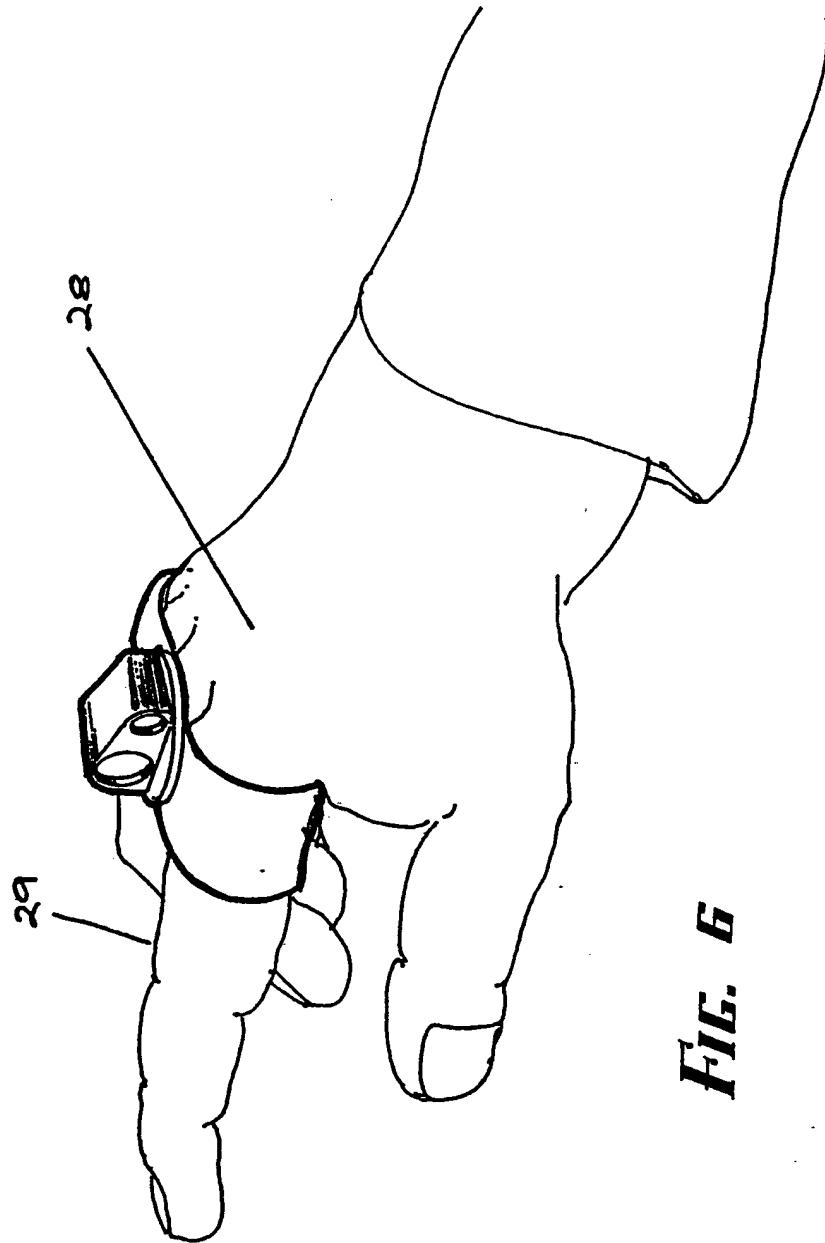


FIG. 6

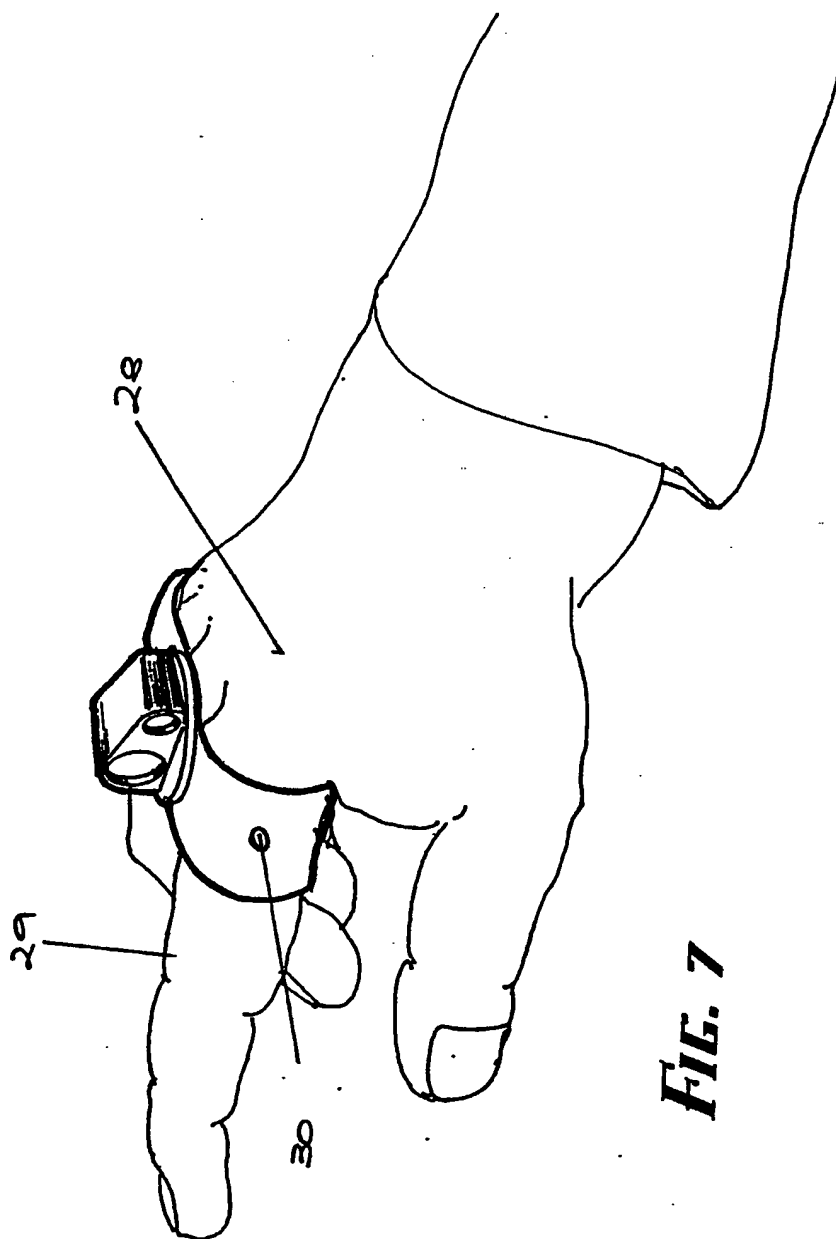


FIG. 7

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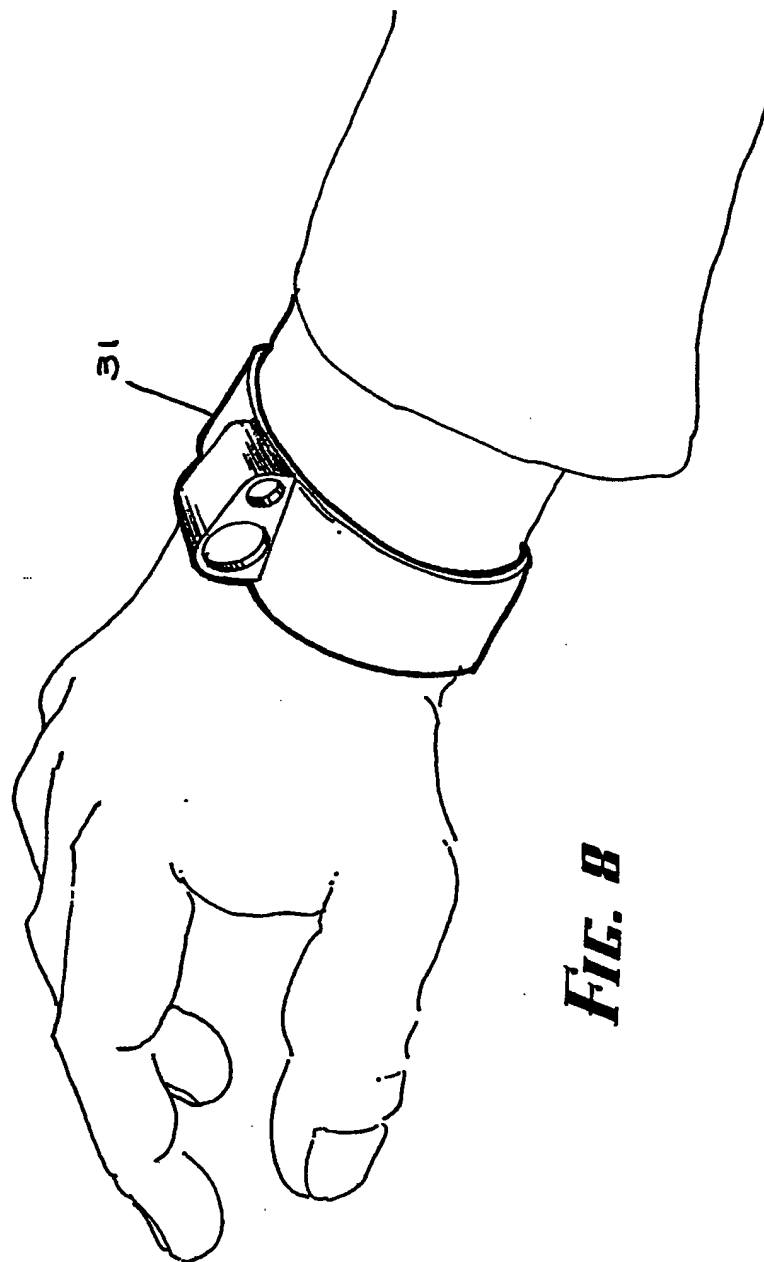


FIG. 8

